normal; the highest was 97°, at Leesburg on the 19th, and the lowest, 12°, at Dale Enterprise on the 6th. The average precipitation was 3.66, or 0.63 above normal; the greatest monthly amount, 8.15, occurred at Hampton, and the least, 1.56, at Manassas.—*E. A. Evans.*

Washington.—The mean temperature was 49.3°, or about 1.5° above normal; the highest was 85°, at Lind on the 25th, and the lowest, 19°, at Ellensburg on the 7th. The average precipitation was 1.88, or over 1.50 below normal; the greatest monthly amount, 8.44, occurred at Clearwater, and the least, trace, at Bridgeport and Lakeside.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 48.0°, or about 4.0° below normal; the highest was 86°, at Eastbank on the 17th, and the lowest, 2°, at Dayton on the 6th. The average precipitation was 3.14, or about 0.25 below normal; the greatest monthly amount, 4.86, occurred at Morgantown, and the least, 1.40, at Huntington.—*C. M. Strong.*

Wisconsin.—The mean temperature was 43.5°, or 1.3° below normal; the highest was 84°, at Brodhead on the 16th, and the lowest, 4°, at Florence on the 5th and at Oceola on the 2d. The average precipitation was 2.42, or 0.59 below normal; the greatest monthly amount, 4.51, occurred at Neillsville, and the least, 0.40, at Bayfield.—*W. M. Wilson.*

Wyoming.—The mean temperature was 44.3°, or 3.5° above normal: the highest was 90°, at Ft. Laramie on the 27th, and the lowest, zero, at Four Bear on the 1st. The average precipitation was 0.93, or 0.60 below normal; the greatest monthly amount, 2.03, occurred at Carbon, and the least, 0.15, at Lowell.—*W. S. Palmer.*

RIVER AND FLOOD SERVICE.

By PARK MORRILL, Forecast Official, in charge of River and Flood Service.

The flood in the lower Mississippi culminated at Cairo on the 6th at a stage of 49.8 feet; during the rest of the month the river fell steadily at this point, except for a slight rise in the last two days. At Memphis the highest water of record, 37.3 feet, was reached on the 11th and 12th. The great height of water at this point, notwithstanding the fact that the flood was not very destructive, is to be explained by the fact that the levees in front of the St. Francis bottom remained nearly intact, and thus forced a large volume of water to descend the channel which, in the past, has passed through the St. Francis swamps. That the volume of flood water was not exceptionally large is shown by the comparatively moderate stage reached at Vicksburg, where the crest was attained on the 24th and 25th at a stage of 49.4 feet.

The great flood wave in the Ohio rapidly subsided during the first ten days of the month. The high water in the Missouri and Arkansas, at the beginning of the month, also soon decreased to the usual low stages. During the latter half of the month all the great tributaries of the Mississippi were at their normal heights, and the danger of flood may now be regarded as past.

The highest and lowest water, mean stage, and monthly range at 117 river stations are given in the accompanying table. Hydrographs for typical points on seven principal rivers are shown on the chart. The stations selected for charting are: Keokuk, St. Louis, Cairo, Memphis, and Vicksburg, on the Mississippi; Cincinnati, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

For fuller details see Monthly Bulletin of the River and Flood Service for April, 1898.

Heights of rivers above zeros of gauges, April, 1898.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,957	14	4.1	15, 16	3.0	27-30	3.7	1.1
Reeds Landing, Minn	1,887	12	3.4	2	2.7	12, 13	3.1	0.7
La Crosse, Wis	1,822	10	5.1	2, 3, 27, 28	4.2	13, 16	4.7	0.9
North McGregor, Iowa	1,762	18	6.0	30	4.4	15-18	5.2	1.6
Dubuque, Iowa	1,702	15	5.7	6, 7, 30	4.4	16-18	5.1	1.3
Leclaire, Iowa	1,612	10	3.9	8, 9	3.1	18, 19	3.5	0.8
Davenport, Iowa	1,596	15	5.0	8, 9	4.1	18, 19	4.6	0.9
Galland, Iowa	1,475	8	3.0	1	2.4	22	2.7	0.6
Keokuk, Iowa	1,466	14	5.1	14	3.8	22	4.5	1.3
Hannibal, Mo	1,405	17	7.6	15	5.2	22	6.0	2.4
Grafton, Ill	1,307	23	15.5	1	10.0	30	12.5	5.5
St. Louis, Mo	1,264	30	22.8	1	13.5	24	17.1	9.3
Chester, Ill	1,189	30	20.4	1	10.2	25	13.8	10.2
Cairo, Ill	1,073	40	49.8	6	27.0	27	39.8	22.8
Memphis, Tenn	843	33	37.3	11, 12	20.7	29	32.3	16.6
Helena, Ark	767	44	49.1	17	35.0	30	44.7	14.1
Arkansas City, Ark	635	42	51.2	19-21	43.0	1	48.8	8.2
Greenville, Miss	595	40	46.2	21	36.5	1	43.2	9.7
Vicksburg, Miss	474	41	49.4	24, 25	39.4	1	46.4	10.0
New Orleans, La	108	16	16.9	27, 28	13.4	1	15.6	3.5

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Arkansas River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Wichita, Kans	720	10	2.7	30	1.2	2, 4-12, 15-17	1.5	0.5
Fort Smith, Ark	345	22	14.3	1	4.6	19	7.3	9.7
Dardanelle, Ark	250	21	16.7	1	5.0	18, 19	8.2	11.7
Little Rock, Ark	170	23	21.0	1	7.0	30	11.0	14.0
White River.								
Newport, Ark	150	26	30.7	1	13.1	29, 30	20.6	17.6
Des Moines River.								
Des Moines, Iowa	150	19	4.4	19-23	4.1	1, 10, 14-17	4.2	0.3
Illinois River.								
Peoria, Ill	135	14	19.2	1	10.9	30	14.4	8.3
Missouri River.								
Bismarck, N. Dak	1,201	14	10.7	15	3.5	11	5.7	7.2
Pierre, S. Dak	1,006	14	8.7	17	1.8	14	4.3	6.9
Sioux City, Iowa	676	19	12.7	30	5.9	16	7.7	6.8
Omaha, Nebr	561	18	12.3	21	6.4	5-7, 12, 17-19	7.8	5.9
St. Joseph, Mo	373	10	7.6	23	1.3	1, 2	3.3	6.3
Kansas City, Mo	280	21	14.2	24	6.4	2	8.7	7.8
Boonville, Mo	191	20	12.6	25	6.6	5, 20-23	8.2	6.0
Hermann, Mo	95	24	13.1	1	6.8	22	9.2	6.3
Ohio River.								
Pittsburg, Pa	966	22	13.5	26	3.9	23	6.9	9.6
Davis Island Dam, Pa	960	25	13.2	27	5.9	23	8.4	7.3
Wheeling, W. Va	875	36	23.0	1	7.0	23	10.7	16.0
Parkersburg, W. Va	785	35	26.2	1	8.5	24	12.9	17.7
Point Pleasant, W. Va	703	36	39.0	1	9.0	25	16.9	30.0
Catlettsburg, Ky	651	50	47.5	1	12.3	25	21.8	35.2
Portsmouth, Ohio	612	50	50.5	1	13.8	25	23.3	36.7
Cincinnati, Ohio	499	45	56.5	1	16.5	27	27.1	40.0
Louisville, Ky	367	24	35.0	1	7.8	28	13.3	27.2
Evansville, Ind	184	30	44.8	2, 3	16.1	30	28.0	28.7
Paducah, Ky	47	40	47.3	6	19.6	27	33.7	27.7
Allegheny River.								
Warren, Pa	177	7	6.8	25	1.4	19-21	2.8	5.4
Oil City, Pa	123	13	6.8	25	1.8	20	3.4	5.0
Parkers Landing, Pa	73	20	7.7	25	1.5	18-20	3.2	6.2
Freeport, Pa	26	20	11.1	1, 26	3.5	30-22	5.8	7.6
Conemaugh River.								
Johnstown, Pa	64	7	4.1	1	2.0	14, 19, 22, 23	2.5	2.1
Red Bank Creek.								
Brookville, Pa	35	8	1.6	1	0.4	12-23	0.8	1.2
Beaver River.								
Ellwood Junction, Pa	10	14	3.0	25	1.2	19	1.7	1.8
Cumberland River.								
Burnside, Ky	434	50	14.8	15	5.6	24	8.9	9.2
Carthage, Tenn	257	30	17.1	17	8.9	27	12.6	8.2
Nashville, Tenn	175	40	23.3	1	12.9	28	17.8	10.4
Great Kanawha River.								
Charleston, W. Va	61	30	17.0	1	5.3	24	7.7	11.7
New River.								
Hinton, W. Va	95	14	6.0	1	2.2	24	3.4	3.8
Licking River.								
Falmouth, Ky	30	25	6.8	1	2.6	12, 13	3.6	4.2
Miami River.								
Dayton, Ohio	69	18	4.7	1	2.3	23	2.9	2.4
Monongahela River.								
Weston, W. Va	161	18	6.0	26	—0.9	12	0.7	6.9
Fairmont, W. Va	119	25	12.6	26	1.7	23	4.2	10.9
Greensboro, Pa	81	18	15.5	26	8.1	9, 10, 23, 24	9.8	7.4
Lock No. 4, Pa	40	28	20.0	26	8.3	24	11.1	11.7
Cheat River.								
Rowlesburg, W. Va	36	14	5.0	1, 2	3.0	10, 11, 30	4.1	2.0
Youghiogheny River.								
Confluence, Pa	59	10	4.8	16	1.8	29, 30	2.8	3.0
West Newton, Pa	15	23	5.9	16	1.7	12, 14, 24	2.8	4.2
Muskingum River.								
Zanesville, Ohio	70	20	19.5	26	8.4	14, 19, 20	10.6	11.1
Tennessee River.								
Knoxville, Tenn	614	29						
Kingston, Tenn	534	25	12.2	1	2.8	26	5.0	9.4
Chattanooga, Tenn	430	33	18.0	2	6.5	26, 27	9.4	11.5
Bridgeport, Ala	390	24	13.7	2	5.0	23, 24, 27	7.6	8.7
Florence, Ala	220	16	11.5	4	5.9	29, 30	8.3	5.6
Johnsonville, Tenn	94	21	21.7	7	9.4	30	15.3	12.3

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger-line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Clinch River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Speers Ferry, Va	156	20	5.6	1	0.4	30	1.7	5.2
Clinton, Tenn	46	25	16.0	1	4.8	30	8.8	11.2
Wabash River.								
Mount Carmel, Ill	50	15	26.6	1	6.4	24	13.6	20.2
Red River.								
Arthur City, Tex	688	27	16.1	1	3.3	16, 17, 19, 20	6.1	12.8
Fulton, Ark	565	28	22.9	1	5.0	22	11.2	17.9
Shreveport, La	449	39	13.1	7	5.4	26	9.3	7.7
Alexandria, La	139	33	15.1	8,9	7.8	30	1.2	7.3
Atchafalaya Bayou.								
Melville, La	100*	31	33.9	29,30	29.7	1	32.2	4.2
Ouachita River.								
Camden, Ark	340	39	18.0	1	5.9	22	9.6	12.1
Monroe, La	100	40	19.8	30	13.5	18	16.5	6.3
Yazoo River.								
Yazoo City, Miss	80	25	24.4	26-28	14.9	1	20.9	9.5
Chattahoochee River.								
Columbus, Ga	140	20	13.0	6	1.7	19	4.4	11.3
Flint River.								
Albany, Ga	80	20	7.0	10	1.2	1,5	3.2	5.8
Cape Fear River.								
Fayetteville, N. C	100	38	21.5	7	3.9	23	8.7	17.6
Columbia River.								
Umatilla, Oreg	270	25	12.5	30	0.0	1	7.3	12.5
The Dalles, Oreg	166	40	21.3	29,30	5.3	1,2	12.1	16.0
Willamette River.								
Albany, Oreg	99	20	5.5	11,16	3.8	2,6	4.6	1.7
Portland, Oreg	10	15	11.3	30	2.5	3	6.9	8.8
Edisto River.								
Edisto, S. C	75	6	4.8	29,30	2.6	1	3.8	2.2
James River.								
Lynchburg, Va	257	18	5.4	1	1.3	30	2.8	4.1
Richmond, Va	110	12	4.5	1	0.7	23	1.9	3.8
Alabama River.								
Montgomery, Ala	265	35	20.2	7,8	3.7	19,20	9.8	16.5
Selma, Ala	212	35	23.0	8,9	4.7	21	11.9	18.3
Coosa River.								
Rome, Ga	225	30	17.2	6	3.0	17-19,23	5.6	14.2
Gadsden, Ala	144	18	15.8	7,8	3.3	18	7.6	13.5

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Tombigbee River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Columbus, Miss	385	33	12.3	24	0.6	18	5.9	11.7
Demopolis, Ala	155	35	32.9	7	9.3	20	23.9	23.6
Black Warrior River.								
Tuscaloosa, Ala	90	38	38.7	6	8.1	19	20.8	30.6
Pedee River.								
Cheraw, S. C	145	27	22.1	1	1.7	23	5.7	20.4
Black River.								
Kingstree, S. C	60	12	5.1	15-18	3.1	4	4.2	2.0
Lumber River.								
Fairbluff, N. C	10	6	3.9	30	1.1	1	2.8	2.8
Lynch Creek.								
Effingham, S. C	35	12	9.0	30	3.6	2	5.5	5.4
Potomac River.								
Harpers Ferry, W. Va	170	16	8.9	17	2.9	12-15, 26-28	3.9	6.0
Roanoke River.								
Clarksville, Va	155	12	2.2	27	0.6	21,22	1.2	1.6
Sacramento River.								
Redbluff, Cal	241	23	1.2	7-25	1.0	1-6	1.1	0.2
Sacramento, Cal	70	25	14.3	16-19,27	12.5	1,6	13.5	1.8
Santee River.								
St. Stephens, S. C	50	12	8.2	15,16	1.7	1	6.6	6.5
Congaree River.								
Columbia, S. C	37	15	5.6	6	1.3	21-23	2.5	4.3
Wateree River.								
Camden, S. C	45	24	22.0	1	3.5	23	7.7	18.5
Savannah River.								
Augusta, Ga	130	32	18.0	7	6.8	23	10.0	11.2
Susquehanna River.								
Wilkesbarre, Pa	178	14	13.5	26	1.0	18,22,23	4.2	12.5
Harrisburg, Pa	70	17	10.3	27	3.0	24	5.0	7.3
Juniata River.								
Huntingdon, Pa	80	24	5.5	1	3.9	12-23	4.2	1.6
W. Br. of Susquehanna.								
Williamsport, Pa	35	20	8.7	26	2.7	14,15	4.5	6.0
Waccamaw River.								
Conway, S. C	40	7	2.9	9	1.7	4,20,26	2.2	1.2

*Distance to Gulf of Mexico.

SPECIAL CONTRIBUTIONS.

A VISIT TO THE HIGHEST METEOROLOGICAL STATION IN THE WORLD.

By ROBERT DEC. WARD, Instructor in Climatology, Harvard University.
(Dated May 21, 1898.)

The highest meteorological station in the world is situated at an altitude of 19,200 feet on the summit of El Misti, a quiescent volcano near the city of Arequipa, Peru. This is one of a series of eight meteorological stations operated, in connection with the Harvard College Observatory, at Arequipa. The names and altitudes of the several stations are as follows: Mejia, 55 feet; La Joya, 4,141; Arequipa, 8,050; Pampa de los Huesos, 13,400; Misti, base, 15,700; Misti, summit, 19,200; Cuzco, 11,378; Echarati, 3,300. These places are roughly in a south-north line, and extend from the seacoast across both ranges of the Cordillera and down to Echarati, lying in a valley at the head of the Amazon River system.

The establishment of an astronomical and meteorological observatory at Arequipa, and of the seven other meteorological stations which are now operated in connection with it, was the result of a bequest left to the Harvard College Observatory in 1887 by the will of Mr. Uriah A. Boyden. The terms of the will were that the money should be used in establishing an observatory "at such an elevation as to be free, so far as practicable, from the impediments to accurate observation which occur in the observatories now existing, owing to atmospheric influences." Owing to the remarkable clearness and steadiness of the air at Arequipa it was decided, after a careful study of the meteorological conditions in other places, that the permanent observatory should be located here, and the buildings were erected in 1891. Arequipa is about 80 miles from the Pacific Ocean, in latitude 16° 22′ 28″ S., longitude 4^h 46^m 12^s, and about in the middle of the long desert belt which stretches along the west coast of South America from latitude 4° to 30° S.

The small snowfall and comparatively high temperatures on the mountains of Peru offer exceptional opportunities for the establishment of meteorological stations at great altitudes, and since 1892 Harvard University has had the credit of maintaining in Peru the highest meteorological station in the world. In that year a station with ordinary and self-recording meteorological instruments was placed, by Prof. Wm. H. Pickering, at an elevation of 16,650 feet on Charchani, an extinct volcano 20,000 feet high, situated 12 miles north of Arequipa. The exposure of the instruments, however, was not favorable, owing to the fact that the station was in a somewhat sheltered position on the flank of the mountain, and in October, 1893, Prof. Solon I. Bailey, then in charge of the Arequipa Observatory, succeeded in establishing a new station on the summit of the Misti. This station is about 3,500 feet higher than the one on Mont Blanc, and is therefore the highest meteorological station in the world. The shape of the Misti is that of an almost perfect, although more or less truncated, cone, and the conditions of exposure of the instruments are as nearly perfect as it is possible to obtain on a mountain.

The instruments now in use on the summit are dry and wet bulb and maximum and minimum thermometers, rain-gauge, Richard barograph, thermograph, and hygrograph. There is also a meteorograph, constructed by Fergusson, of Blue Hill Observatory, especially for this station, and designed to record temperature, pressure, humidity, and wind direction and velocity, and to run three months without rewinding. This meteorograph has not yet given quite as complete records as it was originally hoped would be obtained